

# National Advisory Committee for Aeronautics

## Research Abstracts

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### CURRENT NACA REPORTS

NACA Rept. 1141

METHOD AND GRAPHS FOR THE EVALUATION OF AIR-INDUCTION SYSTEMS. George B. Brajnikoff. 1953. ii, 22p. diagrs., tab. (NACA Rept. 1141. Formerly TN 2697)

Graphs that allow rapid evaluation of air-induction systems from considerations of their aerodynamic parameters in combination with power-plant characteristics are presented for the supersonic Mach numbers up to 3.0. Restrictions imposed by the engine characteristics on the use of a fixed-size air inlet are discussed and illustrated by means of sample solutions. The relation between the engine characteristics, flight conditions, inlet characteristics, and inlet area for optimum performance is given.

NACA Rept. 1142

DIFFUSION OF HEAT FROM A LINE SOURCE IN ISOTROPIC TURBULENCE. Mahinder S. Uberoi and Stanley Corrsin, Johns Hopkins University. 1953, ii, 29p. diagrs., photos., tab. (NACA Rept. 1142. Formerly TN 2710)

An experimental and analytical study has been made of some features of the turbulent heat diffusion behind a line heated wire stretched perpendicular to a flowing isotropic turbulence. The mean temperature distributions have been measured with systematic variations in wind speed, size of turbulence producing grid, and downstream location of heat source. The nature of the temperature fluctuation field has been studied. A comparison of Lagrangian and Eulerian analyses for diffusion in a nondecaying turbulence yields an expression for turbulent-heat-transfer coefficient in terms of turbulence velocity and a Lagrangian "scale." A convenient form has been deduced for the criterion of interchangeability of instantaneous space and time derivatives in a flowing turbulence.

NACA TM 1365

PAPERS ON SHIMMY AND ROLLING BEHAVIOR OF LANDING GEARS PRESENTED AT STUTTGART CONFERENCE OCT. 16 AND 17, 1941. (Bericht über die Sitzung Flattern und Rollverhalten von Fahrwerken am 16./17. Oktober 1941 in Stuttgart). August 1954. ii, 233p. diagrs., photos., 2 tabs. (NACA TM 1365. Trans. from Lilienthal-Gesellschaft für Luftfahrtforschung, Berlin, Bericht 140)

This report is a compilation of 16 papers dealing with landing gear behavior and tire characteristics which were presented at a conference in Stuttgart in 1941. Four of these papers deal with the rolling stability or veering-off tendency of nose and tail wheel tricycle landing gears. Four others deal with theoretical and experimental studies of the characteristics of pneumatic tires including the side elasticity, the cornering characteristics, and the force distribution between tire and runway. The remaining eight papers deal with theoretical and experimental studies of wheel shimmy.

NACA RM 54G26

EFFECTS OF RESIN COATING METHODS AND OTHER VARIABLES ON PHYSICAL PROPERTIES OF GLASS-FABRIC REINFORCED POLYESTERS. B. M. Axilrod, J. E. Wier and J. Mandel, National Bureau of Standards. August 1954. 22p., 6 tabs. (NACA RM 54G26)

Effects of resin coating methods on properties of glass-fabric laminates with three finishes and two polyester resins were investigated. Coating methods were roller, use of dilute resin solution, resin immersion, use of monomeric styrene, and vacuum impregnation. A normal high-temperature rapid cure and a moderate-temperature slow cure were used. Laminate preparation followed a statistical design to minimize uncontrollable variables. Tests included flexural strength both dry and after water immersion, specific gravity, resin content, and voids content.

NACA RM E54F11

EXPERIMENTAL HEAT-TRANSFER AND FRICTION COEFFICIENTS FOR AIR FLOWING THROUGH STACKS OF PARALLEL FLAT PLATES. Eldon W. Sams and Walter F. Weiland, Jr. August 1954. 33p. diagrs., photo., tab. (NACA RM E54F11)

Forced-convection heat-transfer and pressure-drop data were obtained for stacks of parallel flat plates of short length-to-effective-diameter ratio. Two such stacks were aligned and misaligned in the direction of air flow with gap spacings between stacks of 1/32, 1/8, and 1/4 inch. Data were obtained with heat addition to the downstream stack only over a range of Reynolds number from 15,000 to 80,000 and average surface temperatures of about 680° R. The average and local heat-transfer coefficients were only slightly higher than predicted values from established round tube data. The friction data for both stacks are compared.

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## NACA RM E54F29

A STUDY OF THE RADIATION FROM LAMINAR AND TURBULENT OPEN PROPANE-AIR FLAMES AS A FUNCTION OF FLAME AREA, EQUIVALENCE RATIO, AND FUEL FLOW RATE. Thomas P. Clark and David A. Bittker. August 1954. 33p. diagrs., photos., 2 tabs. (NACA RM E54F29)

For laminar flames of given equivalence ratio, radiation intensity changes linearly with fuel flow rate and photographically measured surface area. Intensity per unit area depends only on equivalence ratio. Turbulent flame radiation intensity is also proportional to fuel flow rate. Laminar and turbulent flames at identical conditions of flow, equivalence ratio, and burner diameter have about the same radiation intensities. Furthermore, the spectral intensity distributions appear to be the same for both types of flame, suggesting that the kinetics may also be the same. These results are compatible with the "extended surface" concept of turbulent flame structure, but do not rule out other theories.

## NACA RM E54F29a

SPARK IGNITION OF FLOWING GASES. IV - THEORY OF IGNITION IN NONTURBULENT AND TURBULENT FLOW USING LONG-DURATION DISCHARGES. Clyde C. Swett, Jr. August 1954. 29p. diagrs., 2 tabs. (NACA RM E54F29a)

A theory of spark ignition is presented that is based on the concept that only a portion of the discharge length, a line source of ignition, is important in the ignition process. Theoretical and experimental comparisons of the energy in this heated zone reveal a relation among the variables of total spark-discharge energy, gas density and velocity, electrode spacing, spark duration, intensity of turbulence, and fuel constants. The limited data available substantiate this relation.

## NACA RM L54G02

RAPID ESTIMATION OF BENDING FREQUENCIES OF ROTATING BEAMS. Robert T. Yntema. August 1954. 18p. diagrs., tab. (NACA RM L54G02)

A procedure is presented in the form of charts which permits the rapid estimation of the natural bending frequencies of helicopter rotor blades both rotating and nonrotating. Since the approach is based on the Southwell equation, an evaluation of the method with regard to such things as higher modes, blade offset, and variable mass and stiffness distribution is also given. The evaluation shows that when nonrotating beam bending modes are used, the Southwell equation yields reasonably accurate bending frequencies for rotating helicopter blades. Example comparisons of frequencies estimated using the charts with values given by the manufacturer for several actual blades show that the simplified procedure yields good practical results.

## NACA TN 3197

MECHANICAL PROPERTIES AT ROOM TEMPERATURE OF FOUR CERMETS OF TITANIUM CARBIDE WITH NICKEL BINDER. Aldie E. Johnson, Jr. August 1954. 22p. diagrs., photos., tabs. (NACA TN 3197)

Room-temperature stress-strain curves are presented for compression, tension, and shear loadings on four compositions of titanium carbide with nickel binder. Values of ultimate strength, modulus of elasticity, modulus of rigidity, Poisson's ratio in the elastic region, density, and hardness for the four materials are tabulated.

## NACA TN 3206

TORSIONAL VIBRATIONS OF HOLLOW THIN-WALLED CYLINDRICAL BEAMS. Edwin T. Kruszewski and Eldon E. Kordes. August 1954. 33p. diagrs., tab. (NACA TN 3206)

Theoretical analyses of the torsional vibrations of hollow thin-walled cylinders are presented. Solutions for beams of arbitrary doubly symmetrical cross section with uniform wall thickness are given for cantilever and free-free beam vibrations. Numerical results are shown for cylinders of rectangular cross section and the influence of bending stresses due to torsion and longitudinal inertia is discussed. The solutions for beams of rectangular cross section are used to investigate the accuracy of a solution based on an analysis of a four-flange box beam.

## NACA TN 3212

A NONLINEAR THEORY OF BENDING AND BUCKLING OF THIN ELASTIC SHALLOW SPHERICAL SHELLS. A. Kaplan and Y. C. Fung, California Institute of Technology. August 1954. 58p. diagrs., photo., 5 tabs. (NACA TN 3212)

The problem of the finite displacement and buckling of a shallow spherical dome is investigated both theoretically and experimentally. Experimental results seem to indicate that the classical criterion of buckling is applicable to very shallow spherical domes for which the theoretical calculation was made. A transition to energy criterion for higher domes is also indicated.

## NACA TN 3223

AN ANALYSIS OF SHOCK-WAVE CANCELLATION AND REFLECTION FOR POROUS WALLS WHICH OBEY AN EXPONENTIAL MASS-FLOW PRESSURE-DIFFERENCE RELATION. Joseph M. Spiegel and Phillips J. Tunnell. August 1954. 23p. diagrs. (NACA TN 3223)

Conditions are derived for cancellation and reflection of two-dimensional shock waves from porous walls with wall suction. An exponential relation between mass flow and pressure differential across the walls is assumed. Applications to three-dimensional shock waves are discussed.

## NACA TN 3224

THEORETICAL INVESTIGATION OF THE EFFECTS UPON LIFT OF A GAP BETWEEN WING AND BODY OF A SLENDER WING-BODY COMBINATION. Duane W. Dugan and Katsumi Hikido. August 1954. 41p. diagrs. (NACA TN 3224)

Slender-body theory is applied to determine the effects upon lift of a gap between wing and body of a slender wing-body combination. Two cases are considered, one in which the wing and body are both inclined at the same angle with respect to the free stream, the other in which the body remains at zero angle of attack and the wing is deflected with respect to the body.

NACA TN 3226

SOME POSSIBILITIES OF USING GAS MIXTURES OTHER THAN AIR IN AERODYNAMIC RESEARCH. Dean R. Chapman. August 1954. 48p. diagrs., 4 tabs. (NACA TN 3226)

A study is made of possible uses in compressible-flow research of various gas mixtures having the same specific-heat ratio as air. Such mixtures require low wind-tunnel power and have other possible applications in compressor research and firing-range research. Certain gas mixtures can be concocted which behave at wind-tunnel temperatures dynamically similar to air at flight temperatures.

NACA TN 3229

THE SMALL-DISTURBANCE METHOD FOR FLOW OF A COMPRESSIBLE FLUID WITH VELOCITY POTENTIAL AND STREAM FUNCTION AS INDEPENDENT VARIABLES. Carl Kaplan. August 1954. 18p. (NACA TN 3229)

The equations of two-dimensional compressible flow are treated according to the Prandtl-Busemann small-disturbance method. In contrast to the usual procedure, the independent variables are the compressible velocity potential and stream function and the dependent variables are the rectangular Cartesian coordinates in the plane of flow. The six first-order differential equations corresponding to the first three iteration steps are put into complex-vector form. The particular integrals of the resulting set of three equations are then directly obtained. As an example, the general results of the analysis are applied to the case of subsonic compressible flow past a sinusoidal wall of small amplitude.

NACA TN 3232

AN ANALYSIS OF THE STABILITY AND ULTIMATE BENDING STRENGTH OF MULTIWEB BEAMS WITH FORMED-CHANNEL WEBS. Joseph W. Semonian and Roger A. Anderson. August 1954. 28p. diagrs., photos. (NACA TN 3232)

Design curves and procedures are presented for calculating the stresses at which wrinkling instability and failure occur in multiweb beams with formed-channel webs. The theory is compared with test data for multiweb beams in bending and a criterion is given for predicting whether a given beam will be susceptible to a wrinkling instability or will buckle in a local mode. The specification for riveting the web attachment flanges to the cover skins of the beams is shown to be an important factor in determining the ultimate strength of this type of construction.

NACA TN 3233

A REVIEW OF PLANING THEORY AND EXPERIMENT WITH A THEORETICAL STUDY OF PURE-PLANING LIFT OF RECTANGULAR FLAT PLATES. Charles L. Shuford, Jr. August 1954. 34p. diagrs. (NACA TN 3233)

A summary is given of the background and present status of the pure-planing flat-plate lift theories. The fundamental assumptions and applicability to actual calculation of the planing lift force are reviewed. A proposed theory based on the consideration of linear lifting-line theory less the suction component of lift plus crossflow effects is presented. A comparison of this theory with existing planing formulas and experimental data is made. The agreement between the results calculated by the proposed theory and the experimental data is satisfactory for engineering calculations of pure-planing rectangular-flat-plate lift and center of pressure.

NACA TN 3234

REDUCTION OF HELICOPTER PARASITE DRAG. Robert D. Harrington. August 1954. 8p. diagrs. (NACA TN 3234)

A reduction in helicopter parasite drag is possible but not profitable except in those cases where high speed and long range are primary requirements. For some of the factors causing drag, reduction in parasite-drag area may result in increased weight whereas, in other cases, it does not. The final design, however, must be a compromise between the reduction of drag and the increase in weight.

NACA TN 3236

WIND-TUNNEL STUDIES OF THE PERFORMANCE OF MULTIROTOR CONFIGURATIONS. Richard C. Dingeldein. August 1954. 10p. diagrs., photo. (NACA TN 3236)

The power requirements measured in static thrust and in level forward flight are presented for a coaxial and a tandem helicopter rotor configuration. The experimental measurements are compared with the results of calculations based on existing NACA single-rotor theory.

NACA TN 3237

HOVERING PERFORMANCE OF A HELICOPTER ROTOR USING NACA 8-H-12 AIRFOIL SECTIONS. Robert D. Powell, Jr. August 1954. 14p. diagrs., photos. (NACA TN 3237)

A helicopter rotor employing NACA 8-H-12 airfoil sections has been tested on the Langley helicopter test tower. Tests were made for two surface conditions, one within -0.002 inch of true airfoil contour and the other within -0.020 inch. The blades within 0.002 inch of true airfoil contour showed an average decrease of 6 to 7 percent in total torque coefficients.



## NACA TN 3238

REVIEW OF INFORMATION ON INDUCED FLOW OF A LIFTING ROTOR. Alfred Gessow. August 1954. 16p. diags., photo., tab. (NACA TN 3238)

A brief review of the available information relating to rotor inflow is presented. The available material is summarized in a table as to flight condition, type of information, source, and the reference papers in which the data can be found. Some representative aspects of some of the reference material are discussed.

## NACA TN 3239

SOME ASPECTS OF THE HELICOPTER NOISE PROBLEM. Harvey H. Hubbard and Leslie W. Lassiter. August 1954. 14p. diags., photo. (NACA TN 3239)

Some aspects of the helicopter noise problem are briefly discussed. These discussions deal with the nature of the problem, some tentative criteria for use in evaluating it, and the physical characteristics of noise from helicopters. Overall noise data are presented for a reciprocating-engine helicopter along with discussions of the characteristics of noise from its various components such as the engine, gearing, and rotors. Some consideration is also given to the noise from tip jet rotor systems.

## NACA TN 3241

AIRFOIL SECTION CHARACTERISTICS AT HIGH ANGLES OF ATTACK. Laurence K. Loftin, Jr. August 1954. 10p. diags. (NACA TN 3241)

Information from the literature and from recent investigations is used to summarize briefly the effects of airfoil section parameters and flow variables on the aerodynamic characteristics of symmetrical airfoils at high angles of attack. The results indicate that airfoil thickness ratio, Reynolds number, Mach number, and surface roughness can all have an important effect on the maximum lift coefficient. Beyond the stall, changes in section thickness ratio appear to have little effect on the aerodynamic characteristics of airfoil sections.

## NACA TN 3244

AERODYNAMIC CHARACTERISTICS OF THE NACA 64-010 AND 0010-1.10 40/1.051 AIRFOIL SECTIONS AT MACH NUMBERS FROM 0.30 TO 0.85 AND REYNOLDS NUMBERS FROM  $4.0 \times 10^6$  TO  $8.0 \times 10^6$ . Laurence K. Loftin, Jr. August 1954. 17p. diags., tab. (NACA TN 3244)

The results of a short two-dimensional investigation to determine the aerodynamic characteristics of the NACA 64-010 and 0010-1.10 40/1.051 airfoil sections are presented. The investigation covered a Mach number range from 0.30 to 0.85 and the corresponding Reynolds number range extended from  $4.0 \times 10^6$  to  $8.0 \times 10^6$ .

## NACA TN 3253

SOME EFFECTS OF EXPOSURE TO EXHAUST-GAS STREAMS ON EMITTANCE AND THERMOELECTRIC POWER OF BARE-WIRE PLATINUM RHODIUM - PLATINUM THERMOCOUPLES. George E. Glawe and Charles E. Shepard. August 1954. 30p. diags., photos. (NACA TN 3253)

Thermocouples were exposed to exhaust gases from the combustion of propane, 72-octane gasoline, and JP-4 fuel. Exposure increased the emissivity of the thermocouple wire, which increased its radiation error. Two methods are presented for determining the emittance of the wires. The emissivity of a clean platinum rhodium - platinum thermocouple was approximately 0.2 in the temperature range investigated, while the emittance of an exposed thermocouple coated with exhaust residue was about 0.5. The exposure caused negligible change in the thermoelectric power of the thermocouples.

## NACA TN 3254

DETERMINATION OF FLAME TEMPERATURES FROM 2000° TO 3000° K BY MICROWAVE ABSORPTION. Perry W. Kuhns. August 1954. 48p. diags., photo., 2 tabs. (NACA TN 3254)

Equations are developed and a procedure is outlined for obtaining flame temperatures from the attenuation of microwaves by temperature-induced free electrons. The electron-molecule collision frequency and the effective ionization potentials of alkali metals are found from the attenuation by a gaseous burner flame in the region 1900° to 2400° K. Temperature data of a liquid-propellant burner flame is presented in the region 2200° to 2900° K.

## NACA TN 3257

EFFECTS OF CHEMICALLY ACTIVE ADDITIVES ON BOUNDARY LUBRICATION OF STEEL BY SILICONES. S. F. Murray and Robert L. Johnson. August 1954. 24p. diags., photos., tab. (NACA TN 3257)

Conventional chemically active additives and more active compounds such as peroxide were investigated. Conventional additives were not effective, but more active materials such as the peroxide did give effective lubrication. However, all the chemically active-type additives were inferior to the solvent-type additions such as the diesters previously studied.

## NACA TN 3258

INVESTIGATION OF MACH NUMBER CHANGES OBTAINED BY DISCHARGING HIGH-PRESSURE PULSE THROUGH WIND TUNNEL OPERATING SUPERSONICALLY. Rudolph C. Haefeli and Harry Bernstein. August 1954. 14p. diags., photos., tab. (NACA TN 3258)

A series of tests was performed to obtain an indication of the transient-flow phenomena caused by discharging a chamber of high-pressure gas into a wind tunnel operating supersonically. Two types of gust

were obtained; one had a maximum Mach number with a practically zero time duration whereas the other had a maximum Mach number with a finite time duration depending on the specific geometry. Such a test facility is applicable as a supersonic longitudinal-gust tunnel for producing transient boosts in Mach number.

NACA TN 3259

INVESTIGATION OF NICKEL-ALUMINUM ALLOYS CONTAINING FROM 14 TO 34 PERCENT ALUMINUM. W. A. Maxwell and E. M. Grala. August 1954. 42p. diags., photos., 7 tabs. (NACA TN 3259)

Alloys containing the intermetallics NiAl and Ni<sub>3</sub>Al were prepared by casting. The melting practice developed was most important for the preparation of sound bodies. Room- and elevated-temperature strengths, ductilities, and susceptibilities to hot-rolling were determined. The 17.5-percent-aluminum alloy had the most outstanding properties and was studied in greatest detail. Creep-rupture strength at 1350° F, impact resistance, thermal shock behavior, oxidation resistance, and effects of thermal treatment on microstructure were determined for the 17.5-percent-aluminum alloy.

NACA TN 3261

A METHOD FOR EVALUATING THE EFFECTS OF DRAG AND INLET PRESSURE RECOVERY ON PROPULSION-SYSTEM PERFORMANCE. Emil J. Kremzier. August 1954. 21p. diags. (NACA TN 3261)

A method for evaluating the effects of inlet pressure recovery and drag on propulsion system thrust minus drag performance from consideration of engine over-all "pumping" characteristics is presented for air-breathing engines. The equations and curves presented facilitate the choice of inlet for maximum thrust minus drag. Illustrative examples of the use of the curves are also included.

NACA TN 3284

EXAMINATION OF THE EXISTING DATA ON THE HEAT TRANSFER OF TURBULENT BOUNDARY LAYERS AT SUPERSONIC SPEEDS FROM THE POINT OF VIEW OF REYNOLDS ANALOGY. Alvin Seiff. August 1954. 38p. diags., tab. (NACA TN 3284)

Experimental data from six investigations of the heat transferred by a turbulent boundary layer at supersonic speeds are studied to see whether or not they are well represented by the modified Reynolds analogy. The heat-transfer data are compared with the existing data on turbulent skin friction at supersonic speeds as affected by Mach number and wall temperature ratio. The effect of the wall temperature ratio on the data is emphasized.

## BRITISH REPORTS

N-32409\*

Forest Products Research Lab. (Gt. Brit.)  
RADIO FREQUENCY AND OTHER HEATING PROCESSES. PROGRESS REPORT ELEVEN - APRIL, 1954. AGEING TESTS ON GLUED JOINTS CURED BY RADIO FREQUENCY HEATING. J. F. S. Carruthers and G. E. Soane. 4p. tab. (Forest Products Research Lab.)

Test specimens of glued beech plywood set by radio frequency glue line heating were tested by applying a splitting tool to each glue line and determining the maximum force required to force apart the laminations. The effect of five glues of the strength of the joints was investigated.

N-32431\*

Aeronautical Research Council (Gt. Brit.)  
EVAPORATION FROM THE SURFACE OF A BODY IN AN AIRSTREAM (WITH PARTICULAR REFERENCE TO THE CHEMICAL METHOD OF INDICATING BOUNDARY-LAYER TRANSITION). P. R. Owen and A. O. Ormerod. 1954. 42p. diags., 8 tabs. (ARC R & M 2875; ARC 14,604. Formerly RAE Aero 2431)

The problem of predicting the rate of transport of a gas from or into the surface of a two-dimensional body in an airstream is discussed. The principle object of the investigation is to provide a means of estimating the time required to obtain an experimental record of boundary-layer transition when a chemical technique is used. The methods evolved should, however, find an application to other forced diffusion phenomena.

N-32432\*

Aeronautical Research Council (Gt. Brit.)  
A REVIEW OF PORPOISING INSTABILITY OF SEAPLANES. A. G. Smith and H. G. White. 1954. 41p. diags., 5 tabs. (ARC R & M 2852; ARC 7741. Formerly MAEE H/Res/173)

A review has been made of the evidence on take-off and landing porpoising instability of seaplanes. The basic types of porpoising and their occurrence have been examined: full-scale results have been correlated with model-scale and theoretical results. Porpoising instability has been divided into three basic types, (a) forebody, (b) forebody-afterbody, and (c) step instability.

N-32433\*

Aeronautical Research Council (Gt. Brit.)  
SYMMETRIC FLUTTER CHARACTERISTICS OF A HYPOTHETICAL DELTA WING. D. L. Woodcock. 1954. 23p. diags. (ARC R & M 2839; ARC 13,378. Formerly RAE Structures 68)

This report considers the flutter characteristics of a hypothetical delta wing. It details the results of quaternary calculations showing the effect on the

reduced critical speed of the shapes and relative natural frequencies of the first two normal modes of the aircraft. From these results the stiffnesses necessary to avoid flutter are deduced for two forms of wing structure. The aerodynamic forces have been obtained by using two-dimensional derivatives multiplied by the cosine of the quarter-chord sweep-back in conjunction with strip theory applied to fore-and-aft strips. This procedure is of doubtful validity for the low aspect-ratio wing considered. With this reservation, however, the results confirm the adequacy of the present Ministry of Supply wing-stiffness requirement.

N-32434 \*

Aeronautical Research Council (Gt. Brit.)  
CHANGES IN CONTROL CHARACTERISTICS WITH  
CHANGES IN FLOW PATTERN AT HIGH SUBSONIC  
SPEEDS. TEST ON AN EC.1250 AEROFOIL WITH  
25 PER CENT CONCAVE CONTROL FLAP,  
PARTS I AND II. R. A. Shaw. 1954. 32p. diagrs.,  
photos., tab. (ARC R & M 2436. Formerly ARC  
11,933; FM 1310; S & C 2264; 0.812; ARC 12,284)

This report describes results obtained in wind-tunnel tests where it was found that considerable changes in flow pattern and pressure distribution around an airfoil with control flap occurred in certain conditions for a small increase in speed or change in incidence or control angle. The changes were found first between  $M = 0.85$  and  $0.87$ , when the shock-stalled flow, which had developed at lower speeds, was replaced, on one surface only, by streamline flow extending almost to the trailing edge.

N-32435 \*

Aeronautical Research Council (Gt. Brit.)  
NOTES ON THE DYNAMIC RESPONSE OF AN AIR-  
CRAFT TO GUSTS AND ON THE VARIATION OF  
GUST VELOCITY ALONG THE FLIGHT PATH WITH  
SPECIAL REFERENCE TO MEASUREMENTS IN  
LANCASTER P.D. 119. Anne Burns. 1954. 18p.  
diagrs. (ARC R & M 2759; ARC 12,797. Formerly  
RAE Structures 47)

A collection of records showing the time histories of strains and accelerations at various parts of a Lancaster flying in clear turbulent air is presented and discussed. The records include specimens taken in cloud at moderate altitudes and in clear air at low altitudes. The amount of oscillation (fundamental) excited by a gust appears to be affected by the variation of gust velocity across the span and the amount of oscillation excited does not appear to show any marked decrease as the airspeed of the aircraft is increased.

N-32436 \*

Aeronautical Research Council (Gt. Brit.)  
AILERON REVERSAL AND WING DIVERGENCE OF  
SWEPT WINGS. E. G. Broadbent and Oia Mansfield.  
1954. 26p. diagrs., 6 tabs. (ARC R & M 2817; ARC  
11,148. Formerly RAE Structures 9)

A method of solution for the aileron reversal speed of a swept wing (with emphasis on sweepback) is developed on the lines of strip and semirigid

theories. The influence of the degree of sweep, wing torsional and flexural stiffness, wing plan form, and aileron plan form is investigated. Families of curves are given for extended variation of these parameters which may be used for the direct estimation of the reversal speed of a given wing by interpolation. A solution is given for the wing divergence speed of a swept wing.

N-32437 \*

Aeronautical Research Council (Gt. Brit.)  
NOTES ON THE INDUCED DRAG OF A WIND-TAIL  
COMBINATION. C. H. Naylor. 1954. 10p. diagrs.,  
tab. (ARC R & M 2528. Formerly ARC 9974;  
Perf. 223)

An expression has been derived for the factor to be applied to ideal induced drag to allow for wing-tail interference. This factor is primarily dependent on the wing-tail lift and span ratios. It is of the order of 1:1 for a normal aircraft when the tailplane carries 10 percent of the weight of the aircraft, and can reach unexpectedly large values of high speed. Charts, generalized curves, and sufficient information are included to permit rapid evaluation of the factor for any particular case.

N-32438 \*

Aeronautical Research Council (Gt. Brit.)  
WING PARACHUTES FOR RECOVERY FROM THE  
SPIN. PART I - GENERAL DESIGN REQUIRE-  
MENTS. G. E. Pringle and T. V. Somerville.  
PART II - WAKE PHENOMENA. D. J. Harper,  
J. R. Mitchell, J. Picken and G. E. Pringle. 1954.  
10p. diagrs., tab. (ARC R & M 2543; ARC 8388;  
ARC 10,762. Formerly RAE Tech. Note Aero 1559;  
Tech. Note Aero 1881)

The wing parachutes of a tailless aircraft prototype failed to open when streamed in an accidental spin. This gave a clue to the existence of a marked wake effect when a parachute is deployed on a tow cable behind a stalled wing. The wake effect is such as to reduce the critical closing speed of the parachute. The effect measured in a wind tunnel diminishes as the cable is lengthened. It is recommended that the cables be made as long as possible up to 1-1/2 spans in length; here the danger of entanglement becomes real.

N-32439 \*

Aeronautical Research Council (Gt. Brit.)  
FURTHER EXPERIMENTS ON AN NACA 23021  
AEROFOIL WITH A 15 PER CENT HANDLEY PAGE  
SLOTTED FLAP IN THE COMPRESSED AIR  
TUNNEL. R. Jones and A. H. Bell. 1954. 16p.  
diagrs., 6 tabs. (ARC R & M 2519. Formerly  
ARC 9864; Perf. 206 S & C 2041)

The NACA 23021 airfoil was tested with a form of flap and slot which was modified by a rounding-off of the trailing edge of the main wing on the lower surface and of the leading edge of the flap, thus making the gap on the lower surface appreciably larger. The model was tested at  $R = 0.75$  to  $7.1 \times 10^6$  over the usual incidence range with flap



settings of  $0^{\circ}$  to  $80^{\circ}$ . The results are very similar to those obtained on an earlier model. An overall check of apparatus and model was obtained by closing the gap at  $60^{\circ}$  flap angle and repeating with satisfactory results some of the tests on the original model.

N-32440 \*

Aeronautical Research Council (Gt. Brit.)  
PUBLISHED REPORTS AND MEMORANDA OF THE  
AERONAUTICAL RESEARCH COUNCIL. 1954.  
6p. (ARC R & M 2450)

N-32441 \*

Aeronautical Research Council (Gt. Brit.)  
STATIONARY RIG EXPERIMENTS ON THE HEAT  
EXTRACTING POWER OF CLOSED THERMO-  
SYPHON COOLING HOLES. H. W. Hahnemann.  
1954. 44p. diagrs., tab. (ARC CP 152)

Information is given on heat flow in closed sodium-filled holes in turbine blades. The rig was a tube filled with fluid, transferring heat upwards by free convection from an electrically heated lower section to a water cooled upper section. The high Grashof numbers obtained in closed thermosyphon holes in actual turbine blades were approached by using tubes of large diameter, and measurements were made with mercury, water, and oil as the heat transporting fluid in order to cover a wide range of Grashof and Prandtl numbers. A formula correlating the results for the three different fluids was obtained.

N-32442 \*

Aeronautical Research Council (Gt. Brit.)  
THE INFLUENCE OF SURFACE WAVES ON THE  
STABILITY OF A LAMINAR BOUNDARY LAYER  
WITH UNIFORM SUCTION. D. A. Spence and D. G.  
Randall. 1954. 29p. diagrs. (ARC CP 161)

In order to estimate the destabilizing effect of waves likely to be encountered on wing surfaces which will be used with boundary layer suction, calculations have been made of the effect of small sinusoidal surface waves on the stability of the asymptotic suction profile. Curves are presented of the percentage increases in local suction flow, necessary to maintain the stability of the boundary layer at the same level as on a completely flat surface for various values of local suction flow, height: wave length ratio, and Reynolds number based on wave length. It is found that for the lower local suction flow or the larger height: wave length ratio the larger the necessary percentage increase in local suction flow.

N-32443 \*

Aeronautical Research Council (Gt. Brit.)  
THE MEASUREMENT OF POSITION ERROR AT  
HIGH SPEEDS AND ALTITUDE BY MEANS OF A  
TRAILING STATIC HEAD. K. W. Smith. 1954.  
34p. diagrs., photo. (ARC CP 160)

The static position error of a service wing-tip leading edge pressure head installation has been measured on a Meteor VII by means of a trailing static head, developed especially for use at high speeds. These tests cover an altitude range from zero to 38,000 ft, and include measurements in "g" turns. The maximum Mach number reached was 0.84. For comparative purposes the static error was also measured at ground level by the aneroid method.

N-32444 \*

Aeronautical Research Council (Gt. Brit.)  
CALIBRATION OF THE R. A. E. NO. 18 (9 IN. x  
9 IN.) SUPERSONIC WIND TUNNEL. PART I -  
PRELIMINARY INVESTIGATIONS. W. T. Lord and  
D. Beastall. 1954. 44p. diagrs., 6 tabs. (ARC  
CP 162)

A detailed account is given of the investigations performed in the RAE No. 18 (9-inch by 9-inch, continuous flow, variable density) supersonic wind tunnel prior to an extensive calibration of the tunnel. Variables which have an important effect on the behavior of the flow are discussed, and preliminary experiments to determine their significance are described. Results of the investigations serve to define the course of the complete calibration, and may provide a useful guide to future calibrations of similar supersonic tunnels. The calibration program is outlined: Part II will deal with tests at atmospheric stagnation pressure, and further tests at various stagnation pressures are proposed.

N-32445 \*

Aeronautical Research Council (Gt. Brit.)  
CALIBRATION OF THE R. A. E. NO. 18 (9 IN. x  
9 IN.) SUPERSONIC WIND TUNNEL. PART II -  
TESTS AT ATMOSPHERIC STAGNATION PRESSURE.  
W. T. Lord, G. K. Hunt, R. J. Pallant and J.  
Turner. 1954. 24p. diagrs., 3 tabs. (ARC CP 163)

This report presents distributions of Mach number in the empty working section of the R. A. E. No. 18 (9-inch by 9-inch) supersonic wind tunnel at nominal Mach numbers of 1.4, 1.5, 1.6, 1.8, and 1.9, for condensation-free flow at atmospheric stagnation pressure and at a stagnation temperature of  $35^{\circ}$ . The major contributions to the nonuniformity of the flow are from the disturbances which arise from the junctions of the windows with the side walls of the tunnel. An indication of the boundaries of the working section for each Mach number is given.

N-32446 \*

Aeronautical Research Council (Gt. Brit.)  
TABULATION OF THE BLASIUS FUNCTION WITH  
BLOWING AND SUCTION. H. W. Emmons and D. C.  
Leigh. 1954. 81p. diagrs., 3 tabs. (ARC CP 157)

The present solutions cover the whole possible range of blowing and suction values. It was in connection with the solution of a combustion problem that the present solutions were obtained. Previous

calculations were given to four decimal places. These hand computed tables generally agree to better than 5 in the last place with the present one. Calculations were done on the Electronic Delay Storage Automatic Calculator.

## MISCELLANEOUS

N-25500

### EFFECTS OF ROUGHNESS AND SUCTION ON TRANSITION FROM LAMINAR TO TURBULENT FLOW.

Hugh L. Dryden. 12p. diags. (Reprint from *Mémoires sur la Mécanique des Fluides*, Ministère de l'Air, Publications Scientifiques et Techniques, p. 49-60, 1954)

The effect of roughness in reducing the gains attainable through the use of suction is described. Boundary layer stability, theoretical results for boundary-layer suction, effects of roughness on transition, experimental data on the effect of suction on transition, and combined effects of roughness and suction are topics included. It is concluded that only an extensive program carefully planned in the light of our present knowledge of roughness effects can settle the question as to whether the theoretically predicted stabilization of the flow can be obtained in practice.

NACA TN 2494

Errata No. 2 on "LIFT AND MOMENT ON OSCILLATING TRIANGULAR AND RELATED WINGS WITH SUPERSONIC EDGES." Herbert C. Nelson. September 1951.

NACA TN 3184

Errata No. 1 on "BUCKLING OF LONG SQUARE TUBES IN COMBINED COMPRESSION AND TORSION AND COMPARISON WITH FLAT-PLATE BUCKLING THEORIES." Roger W. Peters. May 1954.

## UNPUBLISHED PAPERS

N-29537\*

Univ. of Minn., Institute of Technology.  
THERMAL STRESSES IN BOX BEAMS - A THEORETICAL AND EXPERIMENTAL STUDY OF STRESSES IN ALUMINUM ALLOY BOX SECTIONS UNDER GIVEN TEMPERATURE DISTRIBUTIONS. Joseph A. Wise and Paul Andersen. January 1954. 130p. diags., photos. (Univ. of Minn., Institute of Technology)

A theoretical and experimental study of stresses in thin shell box sections due to thermal gradients is presented. The basic theory is first developed for plate-like sections then for box sections. Three

specimens were tested in an attempt to verify the theory. It was concluded that the basic theory has received some support from these tests, but much more extended research is necessary to establish it completely.

## DECLASSIFIED NACA REPORTS

THE FOLLOWING REPORTS HAVE BEEN  
DECLASSIFIED FROM CONFIDENTIAL,  
8/18/54

RM E9D08  
RM L7E15  
RM L7I01  
RM L8A28d  
RM L8F21  
RM L8G14  
RM L9C23  
RM L9H16a  
RM L9I28a

NACA RM A7J05

WIND-TUNNEL INVESTIGATION AT A MACH NUMBER OF 1.53 OF AN AIRPLANE WITH A TRIANGULAR WING. Richard Scherrer and William R. Wimbrow. January 23, 1948. 74p. diags., photos., 2 tabs. (NACA RM A7J05) (Declassified from Confidential, 8/18/54)

Models of a tailless pursuit-type supersonic airplane were tested in the Ames 1- by 3-foot supersonic wind tunnel No. 1. The basic configuration and several modifications were tested in pitch and yaw and with deflections of the constant-chord control surfaces. The control effectiveness was found to be independent of angle of attack and was found to vary linearly with control deflection. The variation of drag with lift was small. All of the configurations tested were longitudinally stable, but most were directionally unstable.

NACA RM E8F07

DESIGN AND PERFORMANCE OF EXPERIMENTAL AXIAL-DISCHARGE MIXED-FLOW COMPRESSOR. II - PERFORMANCE OF IMPELLER. Ward W. Wilcox. August 12, 1948. 21p. diags., photo. (NACA RM E8F07) (Declassified from Confidential, 8/18/54)

Results are presented of preliminary tests on an axial-discharge mixed-flow impeller that was designed to combine the compactness, reliability, and wide operating range of mixed-flow compressor with high flow capacity per unit of frontal area that characterizes the axial-flow compressors. At design tip speed of 1480 feet per second, maximum flow capacity of 18.7 pounds per second, peak adiabatic efficiency of 0.78, and peak total-pressure ratio of 3.7 were obtained. Flow capacity per unit of frontal area for this axial discharge impeller is much greater than that of current commercial mixed-flow compressors but is somewhat less than that for the axial-flow compressors having the highest flow capacity per unit frontal area.



NACA RM L7104

PRELIMINARY TANK TESTS OF NACA HYDRO-SKIS FOR HIGH-SPEED AIRPLANES. John R. Dawson and Kenneth L. Wadlin. November 26, 1947. 19p. diagrs., photos. (NACA RM L7104) (Declassified from Confidential, 8/18/54)

Contains results from tank landings and take-off tests with a dynamic model of a hypothetical jet-propelled airplane equipped with NACA hydro-skis. These results show stable take-offs and landings for the model, although the resistance is high. The resistance, which is not considered necessarily inherent, appears to be acceptable for airplanes equipped with rocket motors. It is concluded that hydro-skis suitable for flush retraction into streamline fuselages offer a practicable means for taking off and landing high-speed airplanes on the water.

NACA RM L7K14

FLIGHT TESTS TO DETERMINE THE EFFECT OF AIRFOIL SECTION PROFILE AND THICKNESS RATIO ON THE ZERO-LIFT DRAG OF LOW-ASPECT-RATIO WINGS AT SUPERSONIC SPEEDS. Ellis Katz. February 9, 1948. 19p. diagrs., photos. (NACA RM L7K14) (Declassified from Confidential, 8/18/54)

Experimental determination of the zero-lift drag at low supersonic speeds of low-aspect-ratio wings with: (1) nonswept round-nose sections having varying degrees of thickness ratio from 0.03 to 0.09 and (2) swept and nonswept wings having round-nose, circular-arc, and diamond sections of 0.09 thickness ratio.

NACA RM L7K24

HIGH-SPEED WIND-TUNNEL TESTS OF A 1/16-SCALE MODEL OF THE D-558 RESEARCH AIRPLANE. BASIC LONGITUDINAL STABILITY OF THE D-558-1. John B. Wright. May 12, 1948. 19p. diagrs., tab. (NACA RM L7K24) (Declassified from Confidential, 8/18/54)

This report contains the results of pitching-moment, lift, and drag measurements with a 1/16-scale model of the D-558-1, with no nose-inlet flow, with both the tail removed and with the tail at a constant setting. The tests were conducted through a Mach number range up to 0.96 in the Langley 8-foot high-speed tunnel. Only a limited analysis has been made. It is indicated that the airplane can experience large changes in static longitudinal stability beyond a Mach number of 0.86. At a Mach number of 0.9 there is a tendency for the airplane to become unstable at low lift coefficients followed by large stable tendency at higher speeds. A part of this change in stability is indicated to be destabilizing effects from wing-fuselage characteristics.

NACA RM L8A05

FLIGHT TESTS TO DETERMINE THE DRAG OF FIN-STABILIZED PARABOLIC BODIES AT TRANSONIC AND SUPERSONIC SPEEDS. Sidney R. Alexander, Leo T. Chauvin and Charles B. Rumsey. April 21, 1948. 24p. diagrs., photos. (NACA RM L8A05) (Declassified from Confidential, 8/18/54)

Two fin-stabilized parabolic bodies of revolution of fineness ratios 7.87 and 12 were flight tested over the transonic and supersonic range. Curves of measured total drag coefficient plotted against Mach number are presented together with estimates of total drag coefficient for several Mach numbers to indicate the reasonable accuracy that can be expected from such predictions. The tests also proved the effectiveness of a simple "drag-separation" type booster arrangement.

NACA RM L8A07

FREE-FLIGHT INVESTIGATION OF THE ROLLING EFFECTIVENESS OF A WING-SPOILER ARRANGEMENT AT HIGH SUBSONIC, TRANSONIC, AND SUPERSONIC SPEEDS. Carl A. Sandahl. May 17, 1948. 10p. diagrs., photo. (NACA RM L8A07) (Declassified from Confidential, 8/18/54)

An investigation of the rolling effectiveness of a wing-spoiler arrangement has been conducted by the use of rocket-propelled test vehicles in free flight. The results obtained for the configuration tested, which probably was not an optimum, indicated that rolling effectiveness was a maximum at about  $M = 0.91$ , decreased abruptly in the Mach number range from 0.92 to about 1.0, and continued to decrease with increasing Mach number to the maximum attained ( $M = 1.73$ ).

NACA RM L8A12

FORCE, STATIC LONGITUDINAL STABILITY, AND CONTROL CHARACTERISTICS OF A 1/16-SCALE MODEL OF THE BELL XS-1 TRANSONIC RESEARCH AIRPLANE AT HIGH MACH NUMBERS. Axel T. Mattson and Donald L. Loving. June 23, 1948. 49p. diagrs., tab. (NACA RM L8A12) (Declassified from Confidential, 8/18/54)

This report contains results obtained to determine the effects of compressibility at high Mach numbers on a 1/16-scale model of the Bell XS-1 transonic research airplane. These results are presented for several model configurations through a Mach number range from 0.4 to approximately 0.925. Presented in the report are the lift, drag, and pitching-moment variations with Mach numbers for angles of attack of  $0^\circ$  and  $3^\circ$  for various stabilizer incidences and elevator deflections. The incremental drag, lift, and pitching-moment characteristics are presented for a fuselage speed retarder.

NACA RM L8A22

QUALITATIVE MEASUREMENTS OF RELATIVE FLAP EFFECTIVENESS AT TRANSONIC SPEEDS ON A SERIES OF FIVE THIN AIRFOILS WITH 25-PERCENT-CHORD FLAPS AND VARIOUS AMOUNTS OF SWEEPBACK. Harold L. Crane and Milton D. McLaughlin. May 17, 1948. 24p. diagrs., photos. (NACA RM L8A22) (Declassified from Confidential, 8/18/54)

Tests were made by the wing-flow method on a series of 3-percent-thick models which had sweepback combinations of leading edge and flap hinge line ranging from  $0^\circ$  to  $45^\circ$ . Full-span flaps were tested in all

cases, and, in addition, a half-span flap was tested on a 45° sweptback model. The Mach number range was from 0.5 to 1.1, and at  $M = 0.8$  the Reynolds number range was approximately 700,000 to 1,500,000. The tests showed that the sweptback flaps were less effective but had a smaller decrease in effectiveness with speed. In no case was there an abrupt change in effectiveness or a complete loss of or reversal of effectiveness.

#### NACA RM L8A28

CURRENT STATUS OF LONGITUDINAL STABILITY. Charles J. Donlan. May 24, 1948. 16p. diags. (NACA RM L8A28) (Declassified from Confidential, 8/18/54)

The problems of static and dynamic longitudinal stability both at high speeds and at low speeds are discussed and data are presented which indicate recent progress made in the solution of these problems.

#### NACA RM L8A28b

DRAG MEASUREMENTS AT TRANSONIC SPEEDS OF TWO BODIES OF FINENESS RATIO 9 WITH DIFFERENT LOCATIONS OF MAXIMUM BODY DIAMETER. Jim Rogers Thompson and Max C. Kurbjun. July 22, 1948. 17p. diags., photos. (NACA RM L8A28b) (Declassified from Confidential, 8/18/54)

Contains total drag measurements by the free-fall method for two bodies of fineness ratio 9 with the maximum diameter located 16.7 percent ahead of and behind the body midpoint. The results are compared with those of previous tests to show the effect of location of maximum body diameter on drag between Mach numbers of 0.85 to 1.08 and to provide some information on the mechanism of the abrupt drag rise which occurs between Mach numbers of 0.95 and 1.00.

#### NACA RM L8A28e

LANDING CHARACTERISTICS OF HIGH-SPEED WINGS. Herbert A. Wilson, Jr. and Laurence K. Loftin, Jr. September 21, 1948. 21p. diags. (NACA RM L8A28e) (Declassified from Confidential, 8/18/54)

The results of investigations of the maximum lift characteristics of wings for airplanes designed to fly at transonic Mach numbers are summarized. It is concluded that maximum lift coefficients of about 1.3 to 1.6 can be obtained for wings of this type with the high-lift devices investigated, leading-edge flaps improve the characteristics of the wings, and the drag at high lifts is of importance in determining the landing characteristics.

#### NACA RM L8B03

LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS OF A SEMISPAN AIRPLANE MODEL AT TRANSONIC SPEEDS AS OBTAINED BY THE TRANSONIC-BUMP METHOD. Joseph Weil and M. Leroy Spearman. July 19, 1948. 23p. diags., tab. (NACA RM L8B03) (Declassified from Confidential, 8/18/54)

Tests were made using the transonic-bump method to determine the longitudinal stability and control characteristics in the transonic range of a semispan air-plane model similar to a proposed research vehicle. A comparison was made with results obtained for the same model by the NACA wing-flow method. The model was mounted on a pivot and was free to trim at zero pitching moment. The lift coefficient and angle of attack for trim at various stabilizer settings were obtained for four center-of-gravity positions. The tests were made through a Mach number range from 0.60 to 1.20.

#### NACA RM L8B06

HIGH-SPEED WIND-TUNNEL TESTS OF A 1/16-SCALE MODEL OF THE D-558 RESEARCH AIRPLANE. D-558-1 SPEED-REDUCTION BRAKE AND SYMMETRICAL-PROFILE WING CHARACTERISTICS. John B. Wright. June 15, 1948. 22p. diags., tab. (NACA RM L8B06) (Declassified from Confidential, 8/18/54)

Contains a limited analysis of the results of pitching-moment, lift, and drag measurements with a 1/16-scale model of the D-558-1 through a Mach number range up to 0.96 in the Langley 8-foot high-speed tunnel. Tests of the model were made with speed-reduction brakes on the fuselage sides fully deflected. Tests were also made with the model (without brakes) utilizing a wing of symmetrical profile. Included for comparison are data for the model without the brakes and for the model with a cambered wing.

#### NACA RM L8B18

TANK SPRAY TESTS OF A JET-POWERED MODEL FITTED WITH NACA HYDRO-SKIS. Kenneth L. Wadlin and John A. Ramsen. July 22, 1948. 19p. diags., photos. (NACA RM L8B18) (Declassified from Confidential, 8/18/54)

Contains tank results of take-off tests with a powered dynamic model of a hypothetical jet-propelled high-speed airplane, fitted with NACA hydro-skis, and having flush turbojet intakes on the upper part of the fuselage near the nose. It was concluded that take-offs can be made without spray entering the intakes by using very small longitudinal strips. The tendency of the turbojet inflow to draw spray into the intakes is slight. Jet power increased trims during the high-speed part of the take-off run.

#### NACA RM L8B19

LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS OF A SEMISPAN AIRPLANE MODEL WITH A SWEEPBACK WING AND TAIL FROM TESTS AT TRANSONIC SPEEDS BY THE NACA WING-FLOW METHOD. Richard H. Sawyer and Lindsay J. Lina. July 23, 1948. 42p. diags., photos., tab. (NACA RM L8B19) (Declassified from Confidential, 8/18/54)

The angle of attack and lift coefficient obtained under trimmed (zero pitching-moment) conditions with fixed controls are presented for Mach numbers from 0.50 to 1.07 for a semispan airplane model having a 45° sweptback wing and tail. The effects of



Reynolds number and the effectiveness of a wing flap similar to a dive-recovery flap on a straight wing also were investigated briefly. Comparison is made with previous tests of the model equipped with, first, an unswept wing and tail and, second, with an unswept wing and sweptback tail.

NACA RM L8B26

PRELIMINARY FREE-FLIGHT INVESTIGATION OF THE EFFECT OF AIRFOIL SECTION ON AILERON ROLLING EFFECTIVENESS AT TRANSONIC AND SUPERSONIC SPEEDS. Carl A. Sandahl. June 25, 1948. 6p. diagsr. (NACA RM L8B26) (Declassified from Confidential, 8/18/54)

Results have been obtained by means of a free-flight technique utilizing rocket propulsion which indicate that aileron-rolling-effectiveness characteristics are affected adversely by variations in airfoil section which produce large increases in the trailing-edge angle.

NACA RM L8C23

HIGH-SPEED WIND-TUNNEL TESTS OF A 1/16-SCALE MODEL OF THE D-558 RESEARCH AIRPLANE. LONGITUDINAL STABILITY AND CONTROL OF THE D-558-1. John B. Wright. July 8, 1948. 47p. diagsr., tab. (NACA RM L8C23) (Declassified from Confidential, 8/18/54)

This paper contains the results of pitching-moment and lift measurements with a 1/16-scale model of the D-558-1, with no nose-inlet flow, and at several stabilizer and elevator settings. The tests were conducted up to a Mach number of 0.96 in the Langley 8-foot high-speed tunnel. Only a limited analysis of the various stability and control parameters is presented.

NACA RM L8C25

AERODYNAMIC LOSSES IN LOW-PRESSURE TAILPIPE EXHAUST DUCTS FOR ROCKET-PROPELLED AIRCRAFT. W. K. Hagginbotham and J. G. Thibodaux. July 20, 1948. 15p. diagsr., photos. (NACA RM L8C25) (Declassified from Confidential, 8/18/54)

An evaluation of the aerodynamic losses involved in the use of exhaust ducts for rocket-propelled aircraft was obtained from thrust stand tests. The aerodynamic losses created by the use of low-pressure tailpipe exhaust ducts for rocket-propelled aircraft are within practical limits insofar as overall propulsion requirements for pilotless-aircraft models are concerned.

NACA RM L8D21

PRELIMINARY INVESTIGATION OF VARIOUS AILERONS ON A 42° SWEEPBACK WING FOR LATERAL CONTROL AT TRANSONIC SPEEDS. Thomas R. Turner, Vernard E. Lockwood and Raymond D. Vogler. September 7, 1948. 35p. diagsr., photo. (NACA RM L8D21) (Declassified from Confidential, 8/18/54)

Contains the rolling-moment characteristics for a reflection-plane model with 42.8° leading-edge sweep, aspect ratio 4.0, and taper ratio 0.50 for several aileron configurations (chord and contour change) in the transonic speed range. The paper also includes some rolling-moment characteristics for spoilers, wing-tip aileron, and leading-edge flaps through the transonic speed range at Mach numbers from 0.5 to 1.15.

NACA RM L8E14

LIMITED MEASUREMENTS OF STATIC LONGITUDINAL STABILITY IN FLIGHT OF DOUGLAS D-558-1 AIRPLANE (BUAERO NO. 37971). Walter C. Williams. June 24, 1948. 10p. diagsr., photos., tab. (NACA RM L8E14) (Declassified from Confidential, 8/18/54)

Contains a few measurements of the variation of elevator angle and elevator force with Mach number at 30,000 feet altitude up to a Mach number of 0.85. These data show that the airplane possessed positive static longitudinal stability up to a Mach number of 0.80. A trim change in the nose-down direction occurred for Mach numbers above 0.82.

NACA RM L8E14a

FLIGHT MEASUREMENT OF THE STABILITY CHARACTERISTICS OF THE DOUGLAS D-558-1 AIRPLANE (BUAERO NO. 37971) IN SIDESLIPS. Walter C. Williams. April 18, 1949. 23p. diagsr., photos. (NACA RM L8E14a) (Declassified from Confidential, 8/18/54)

Measurements have been made of the stability characteristics of the D-558-1 airplane in steadily increasing sideslips at various Mach numbers from 0.50 to 0.80 at 10,000 feet altitude and at Mach numbers from 0.50 to 0.84 at 30,000 feet altitude. The results of these tests show that the apparent directional stability of the airplane is high and increases with increasing Mach number and dynamic pressure. The dihedral effect is positive at all speeds, there is little or no change in pitching moment with sideslip, and the cross-wind force is positive.

NACA RM L8E27

FLIGHT TESTS OF A TWO-DIMENSIONAL WEDGE DIFFUSER AT TRANSONIC AND SUPERSONIC SPEEDS. M. A. Faget. August 11, 1948. 21p. diagsr., photos. (NACA RM L8E27) (Declassified from Confidential, 8/18/54)

A two-dimensional wedge diffuser suitable for use in a ducted-airfoil ram jet was flight tested. Test results at flight speeds from  $M = 0.7$  to  $M = 1.4$  are presented. A velocity survey at the exit of the diffuser showed a large wake effect from the island which was faired behind the central wedge. Curves showing diffuser-exit Mach numbers, velocity, pressure, and mass flow are all smooth throughout the transonic region indicating the diffusion process to be fairly insensitive to passage through the transonic region.



## NACA RM L8F24

## APPLICATION OF ONE PART OF VON KÁRMÁN'S TWO-DIMENSIONAL TRANSONIC SIMILARITY LAW TO DRAG DATA OF NACA 65-SERIES WINGS.

Kenneth B. Amer. August 24, 1948. 9p. diags. (NACA RM L8F24) (Declassified from Confidential, 8/18/54)

Application of one part of Von Kármán's two-dimensional transonic similarity law to drag data of wings having NACA 65-006, 65-009, and 65<sub>1</sub>-012 profiles and aspect ratios of 7.6 in the transonic range shows satisfactory correlation. The presence of various factors in the flow which were not considered in the derivation of the law from the potential flow equation did not appreciably affect the degree of correlation.

## NACA RM L8G29a

DETERMINATION BY THE FREE-FALL METHOD OF THE LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS OF A 1/4-SCALE MODEL OF THE BELL XS-1 AIRPLANE AT TRANSONIC SPEEDS. James T. Matthews, Jr. and Charles W. Mathews. November 9, 1948. 19p. diags., photo., tab. (NACA RM L8G29a) (Declassified from Confidential, 8/18/54)

Report presents results of a free-fall test to determine longitudinal stability and control characteristics of a 1/4-scale model of the Bell XS-1 airplane. The model attained a Mach number of 0.98. Time histories given show variations of elevator position, normal and transverse accelerations, longitudinal retardation, and Mach number throughout the fall. Variations with Mach number of lift coefficient, drag coefficient, and lift-to-drag ratio are also presented. Observations on and explanations of the behavior of the model are included.

## NACA RM L8G30

LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS OF A SEMISPAN MODEL OF A SUPERSONIC AIRPLANE CONFIGURATION AT TRANSONIC SPEEDS FROM TESTS BY THE NACA WING-FLOW METHOD. Norman S. Silsby and James M. McKay. November 8, 1948. 30p. diags., photos., tab. (NACA RM L8G30) (Declassified from Confidential, 8/18/54)

The investigation was made by the NACA wing-flow method of the longitudinal stability and control characteristics in the transonic range of a semispan model of a supersonic airplane configuration having a long slender fuselage and straight wing and tail with faired double-wedge airfoil sections 4.6 percent thick, aspect ratio 4.0, and taper ratio 2.

## NACA RM L8H05

HIGH-SPEED WIND-TUNNEL TESTS OF A 1/16-SCALE MODEL OF THE D-558 RESEARCH AIRPLANE - DYNAMIC PRESSURE AND COMPARISON OF POINT AND EFFECTIVE DOWNWASH AT THE TAIL OF THE D-558-1. Harold L. Robinson. November 4, 1948. 27p. diags. (NACA RM L8H05) (Declassified from Confidential, 8/18/54)

The results indicate that the downwash changes that occur at the tail location of the D-558-1 airplane are not the cause for the instability reported in previous papers. The tests include a Mach number range of 0.40 to 0.94 and a lift-coefficient range of -0.3 to 0.7. The rate of change of point downwash with lift coefficient decreases at high speeds and low lift coefficient, thus causing a stabilizing effect. The appendices of this paper give a method of correlating stability with downwash and also give a method of including tail drag when measuring downwash by the tail-on and tail-off methods.

## NACA RM L8H06a

## EFFECT OF DOWNWASH ON THE ESTIMATED ELEVATOR DEFLECTION REQUIRED FOR TRIM OF THE XS-1 AIRPLANE AT SUPERSONIC SPEEDS.

James T. Matthews, Jr. November 1, 1948. 11p. diags. (NACA RM L8H06a) (Declassified from Confidential, 8/18/54)

Contains estimation of elevator deflections required for trim at supersonic speeds of the XS-1 including the effect of downwash determined from linearized theory. Results indicate that increasing up-elevator deflection is required in level flight as the Mach number increases from 1.1 to about 1.6 with a slight reduction of up elevator occurring between 1.6 and 2.0. The reasons for these trends have been analyzed and are presented in the paper.

## NACA RM L8I23

ADDITIONAL FREE-FLIGHT TESTS OF THE ROLLING EFFECTIVENESS OF SEVERAL WING-SPOILER ARRANGEMENTS AT HIGH SUBSONIC, TRANSONIC, AND SUPERSONIC SPEEDS. H. Kurt Strass. November 24, 1948. 16p. diags., photos. (NACA RM L8I23) (Declassified from Confidential, 8/18/54)

Additional results of an aerodynamic-control-effectiveness investigation using free-flight, rocket-propelled test vehicles have been obtained recently which show some results of chordwise spoiler location and a comparison of a sharp-edge spoiler with a wedge-type spoiler at the 0.8-chord location and a plain, full-span, 0.2-chord aileron with a deflection equal to 4.4°.

## NACA RM L8J21

THE EFFECT OF AIR JETS SIMULATING CHINES OR MULTIPLE STEPS ON THE HYDRODYNAMIC CHARACTERISTICS OF A STREAMLINE FUSELAGE. Bernard Weinfeld. January 7, 1949. 37p. diags., photos., 2 tabs. (NACA RM L8J21) (Declassified from Confidential, 8/18/54)

Preliminary tests were made to determine the effect of forced ventilation on the hydrodynamic characteristics of a streamline fuselage of a hypothetical transonic airplane. This forced ventilation consisted of air ejected at about 300 feet per second through small orifices distributed over the fuselage bottom in various patterns simulating chines and/or multiple steps. Data are presented on the resistance, trim, and effective hydrodynamic lift for the basic model and for

each of the jet configurations. All of the jet configurations caused appreciable improvement in hydrodynamic performance, especially at higher speeds.

NACA RM L8K01

EFFECT OF WING SWEEP, TAPER, AND THICKNESS RATIO ON THE TRANSONIC DRAG CHARACTERISTICS OF WING-BODY COMBINATIONS. Jim Rogers Thompson and Charles W. Mathews. December 31, 1948. 29p. diagrs., photos., 2 tabs. (NACA RM L8K01) (Declassified from Confidential, 8/18/54)

Contains free-fall measurements of the transonic drag characteristics of three wing-body combinations having 35° sweptback wings with thickness ratios of 0.09 and 0.12 and taper ratios of 1:1 and 1.467:1. Results are compared with measurements for four related configurations reported previously and with theoretical calculations to show the effects of wing sweep, taper, and thickness ratio on the transonic drag characteristics of wing-body combinations and their component parts.

NACA RM L8K02

AERODYNAMIC CHARACTERISTICS AT SUBSONIC AND TRANSONIC SPEEDS OF A 42.7° SWEEPBACK WING MODEL HAVING AN AILERON WITH FINITE TRAILING-EDGE THICKNESS. Thomas R. Turner, Vernard E. Lockwood and Raymond D. Vogler. January 12, 1949. 24p. diagrs., photo. (NACA RM L8K02) (Declassified from Confidential, 8/18/54)

This paper contains the aerodynamic characteristics for a reflection-plane model having 42.7° leading-edge sweep, an aspect ratio of 4.0, and a taper ratio of 0.50 with an aileron of various finite trailing-edge thicknesses. The aerodynamic characteristics which include aileron rolling moments were obtained through the transonic-speed range from a Mach number of 0.5 to 1.15. The tests were performed in transonic flow over a bump on the tunnel floor and in subsonic flow on one of the tunnel side walls.

NACA RM L8K03

STABILITY RESULTS OBTAINED WITH DOUGLAS D-558-1 AIRPLANE (BUAERO NO. 37971) IN FLIGHT UP TO A MACH NUMBER OF 0.89. William H. Barlow and Howard C. Lilly. April 22, 1949. 16p. diagrs., photos. (NACA RM L8K03) (Declassified from Confidential, 8/18/54)

Contains flight measurements of trim characteristics in straight flight for two stabilizer settings for D-558-1 airplane up to a Mach number of 0.89. Also shows elevator angle per unit normal-force coefficient and elevator control force per unit acceleration up to a Mach number of 0.82. The buffet boundary is well defined up to a Mach number of 0.84 and is shown in comparison with that of the XS-1 airplane with the same wing section, 65-110.

NACA RM L8K23a

THEORETICAL ANALYSIS OF THE ROLLING MOTIONS OF AIRCRAFT USING A FLICKER-TYPE AUTOMATIC ROLL STABILIZATION SYSTEM HAVING A DISPLACEMENT-PLUS-RATE RESPONSE. Howard J. Curfman, Jr. January 12, 1949. 29p. diagrs., 2 tabs. (NACA RM L8K23a) (Declassified from Confidential, 8/18/54)

A general analysis of the steady-state rolling oscillations of aircraft using the displacement-plus-rate response, flicker-type automatic roll stabilization system is presented, and charts are included for finding the amplitude and period of these oscillations for any aircraft. The addition of the rate-sensitive element to the displacement-response, flicker-type system reduces the amplitude and increases the frequency of the steady-state oscillations. Current trends in pilotless-aircraft designs indicate that small amplitude residual oscillations are possible. The analysis shows close agreement with roll-simulator tests.

NACA RM L8K29

AN INVESTIGATION OF AILERON OSCILLATIONS AT TRANSONIC SPEEDS ON NACA 23012 AND NACA 65-212 AIRFOILS BY THE WING-FLOW METHOD. Harold L. Crane. December 29, 1948. 9p. diagrs., photo. (NACA RM L8K29) (Declassified from Confidential, 8/18/54)

An investigation is being conducted to determine the feasibility of studying aileron buzz by means of the wing-flow method. Two semispan models which had an aspect ratio of 6 and a taper ratio of 2 with quarter-chord half-span mass-balanced ailerons have been used. One had an NACA 23012 airfoil section and the second, an NACA 65-212 airfoil section. The ailerons on both models were subject to buzz over a small range of Mach number near 0.9. Data obtained by wing-flow testing agreed reasonably well with full-scale flight results.

NACA RM L8L07

ESTIMATION OF LIFT AND DRAG OF AIRFOILS AT NEAR SONIC SPEEDS AND IN THE PRESENCE OF DETACHED SHOCK WAVES. John P. Mayer. February 23, 1949. 23p. diagrs. (NACA RM L8L07) (Declassified from Confidential, 8/18/54)

A semiempirical method of estimating the forces on airfoils at near sonic speeds and in the presence of detached shock waves is presented. Fairly good agreement with the trend of existing experimental data is found at Mach numbers from 0.95 to 2.3 for sharp-nose airfoils at speeds and angles of attack above those at which shock detachment occurs and for blunt-nose airfoils where shock waves always are detached. Computed values of the forces on two-dimensional wings are in good agreement with wind-tunnel data on three-dimensional wings at high angles of attack. The approximate method is in agreement with Von Kármán transonic similarity laws.

## NACA RM L9J12

National Advisory Committee for Aeronautics.  
LOW-SPEED STATIC LATERAL STABILITY CHARACTERISTICS OF A CANARD MODEL HAVING A 60° TRIANGULAR WING AND HORIZONTAL TAIL. William R. Bates. November 23, 1949. 29p. diags., tab. (NACA RM L9J12) (Declassified from Confidential, 8/18/54)

Contains results of force tests and flow surveys made in the Langley free-flight tunnel to determine the stability characteristics of a canard model having 60° triangular plan-form wing and horizontal tail. Tests were made with the horizontal tail used as a fixed nose elevator or floating freely at various tab deflections. Various vertical-tail configurations were also studied. Unusual directional stability characteristics were obtained from the results.

## NACA RM L9J28

LOW-SPEED INVESTIGATION OF DEFLECTABLE WING-TIP AILERONS ON AN UNTAPERED 45° SWEEPBACK SEMISPAN WING WITH AND WITHOUT AN END PLATE. Jack Fischel and James M. Watson. December 14, 1949. 32p. diags., photo. (NACA RM L9J28) (Declassified from Confidential, 8/18/54)

Contains results and discussion of a low-speed investigation of triangular- and parallelogram-plan-form deflectable wing-tip ailerons on an untapered 45° sweptback semispan wing with and without a rectangular end plate (simulating a vertical fin)

mounted on the wing inboard of the ailerons. Lift and lateral-control data were obtained through a large angle-of-attack range and a large aileron-deflection range for each aileron plan form on the plain wing and the wing with end-plate. Aileron plan form had little or no effect, whereas the end plate had measurable effect on lift, drag, and rolling-moment data. These ailerons should provide adequate control over the entire angle-of-attack range.

## NACA RM L9K10a

AERODYNAMIC CHARACTERISTICS OF A WING WITH QUARTER-CHORD LINE SWEEP BACK 35°, ASPECT RATIO 6, TAPER RATIO 0.6, AND NACA 65A006 AIRFOIL SECTION. TRANSONIC-BUMP METHOD. William C. Sleeman, Jr. and William D. Morrison, Jr. December 12, 1949. 32p. diags., photos., tab. (NACA RM L9K10a) (Declassified from Confidential, 8/18/54)

This paper presents the results of an investigation by the transonic-bump method of a wing-fuselage combination employing a 35° sweptback wing with aspect ratio 6, taper ratio 0.6, and an NACA 65A006 airfoil section. Lift, drag, pitching moment, and root bending moment were obtained for the wing-alone and wing-fuselage configurations over a Mach number range of 0.60 to 1.18. Effective downwash angles and dynamic-pressure characteristics in the region of a probable tail location were also obtained and are presented for a range of tail heights at one tail length.



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